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Doherty
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Date Out EFB: MAY 5 1981

To: Product Manager 17 Gee
TS-767

From: Dr. Willa Garner ^{III}
Chief, Review Section No. 1
Environmental Fate Branch

Attached please find the environmental fate review of:

Reg./File No.: 279-3014, 10182-18

Chemical: Permethrin

Type Product: Insecticide

Product Name: Pounce and Ambush

Company Name: ICI Americas and FMC

Submission Purpose: Review of field monitoring studies

ZBB Code: other

ACTION CODE: 570

Date in: 3/4/81

EFB # 778,779

Date Completed: MAY 5 1981

TAIS (level II)

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Deferrals To:

60

3

☒ Ecological Effects Branch

☒ Residue Chemistry Branch

☒ Toxicology Branch

1.0 INTRODUCTION

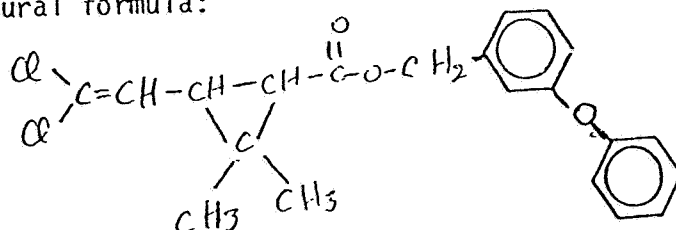
1.1 Purpose

ICI Americas and FMC Corp. Incorporation are requesting review of field monitoring studies as part of the requirements for conditional registration of permethrin [submission of 1/15/81]. Permethrin is currently registered under the trade name "Ambush" by ICI Americas (# 10182-18), and "Pounce" by FMC Corp. (# 279-3014).

1.2 Chemical

Common Name	: Permethrin
Trade Name	: Ambush
Code Numbers	: R86557, FMC 33297, NIA33297, PP557, NRDC143
Type	: Insecticide
Chemical Name	: (3-phenoxyphenyl)methyl(+)-cis, trans-3-(2,2-dichloroethenyl)- 2,2-dimethylcyclopropanecarboxylate- 25.6% (2 lbs ai/gal). <u>Cis/trans</u> ratio Min 35% (+) <u>cis</u> and max 65% (+) <u>trans</u> .

Structural formula:



Molecular formula: $C_{21}H_{20}O_3Cl_2$

Chemical and Physical Properties of Active Ingredient:

Molecular weight	: 391.28
Boiling point	: 220 °C at 0.05 mm Hg pressure
Vapor Pressure	: 1×10^{-6} mm Hg at 50 °C
Density	: 1.21 g/ml
Solubility	: < 0.1 ppm in water miscible In all proportions with most organic solvents.
Physical state	: Liquid
Color	: Colorless
Odor	: Odorless
Corrosive properties	: Non-corrosive to metals
Chemical stability	: Unlike most other pyrethroids the compound is comparatively stable to ultraviolet light. Unstable in highly alkaline solutions.

Chemical and Physical Properties of Ambush Formulation JFU 5054:

Miscibility	: Miscible with water, xylene, kerosene or diesel fuel in all proportions.
Compatibility	: Appears to be compatible with a wide range of insecticides and fungicides
Boiling point	: 172 °F
Flash point	: 140 °F
Vapor pressure	: 24 mm Hg at 25 °C
Explosive Hazards	: No Known Hazard
Weight of active ingredient/gal	: 2+ 0.05 lb
Oxidizing/reducing agent capability	: No known hazard
Viscosity	: 50-60 saybolt units/sec. at 100 °F
Color	: Clear, straw-colored liquid
Storage stability	: No detectable degradation of Ambush formulation JFU 5054 occurred after storage for one year at 5 °C, room temperature, 37 °C or 50 °C.

2.0 DISCUSSION OF DATA

Field monitoring data on the fate of permethrin was conducted by Union Carbide for ICI Americas and FMC Corporation. The report compiled on December 16, 1980, was sent to the EPA on January 15, 1981.

The purpose of this study was to assess the fate of permethrin in the hydrologic cycle after prescribed use on cotton field adjacent to a stream.

The study site was established approximately 20 miles east of Selma, AL in Autauga County. The ecosystem studied comprised a cotton field, two streams, little creek, and the Alabama River. The eastern half of the 30 acres cotton field, had 2-5% slope and the western portion had a zero slope. Estimates of soil properties specific to the test site are shown in Table 1 a. No cover crop was planted prior to cotton. Cotton was planted on May 21, cultivated during June and July, and harvested on November 6, 1980.

Permethrin was aerially applied at 0.2 lb ai/A/application in 2 gallons of water per acre. The ICI and FMC formulations (Ambush and Pounce respectively) were alternatively applied every 5 days for a total of 15 applications.

Sampling was conducted at prescribed dates up to one week following the final application (See Table 1). Cotton foliage, soil from test cotton field, pesticide fall-through, and runoff samples from adjacent streams were collected for analysis. Additionally, duplicate water and sediment samples were collected from designated stations on days of sufficient rainfall to cause significant runoff from the cotton field.

Analytical Procedure

The method used for the analysis of water and sediment samples was a modification of PPRAM-42. The samples were extracted, cleaned up by gel permeation chromatography followed by Florisil column chromatography then analyzed by GLC/EC. Because of the low limits of determination desired, it was necessary to use a 5% diethyl ether in n-hexane for the Florisil column elution rather than 10% diethyl ether in n-hexane and then to re-Florisil the samples. This allowed limits of determination of 2 ppb for sediment and 5 ppt for water. Because of the very low water solubility of permethrin, it was assumed that any residues in the steam water samples would be associated with the suspended solids; therefore, the solids were filtered from the water and the two fractions extracted separately. The extracts were then combined for GC analysis.

Results

Results in Table 2 show that the mean residues on the cotton plants collected before the 5th, 10th, and 15th applications ranged from 3.93 ppm to 7.14 ppm. Residues after the 1st, 5th, 10th, and 15th applications ranged from 7.79 ppm to 17.6 ppm. Seven and twelve days after the 15th application, the mean residues were 8.78 ppm and 4.87 ppm, respectively.

Whatman No. 42 filter paper discs placed under the leaf canopies of cotton plants immediately before each application and collected immediately after the application contained permethrin residues ranging from 0.0002 pounds per acre to 0.0430 pounds per acre with a mean of 0.0132 pounds per acre (Table 3). If it is assumed that exactly 0.2 pounds of permethrin were applied per acre, then only 6.6% of the spray penetrated the foliage and reached the soil.

In Table 4 are the residue results from soil samples collected from areas not protected by the cotton plants. The mean residues from the 6 inch x 6 inch x 3 inch samples collected immediately prior to the 5th, 10th, and 15th applications were 0.17 ppm, 0.30 ppm and 0.40 ppm, respectively. Three soil samples collected seven days after the 15th application had a mean residue of 0.22 ppm permethrin. It was assumed that these residues would be the most likely to be transported to the aquatic environment by rain runoff.

Runoff water, including the suspended solids, collected from the rivulet running towards the test streams contained residues ranging from 3.37 ppb to 15.3 ppb (Table 5.)

Sediment samples collected from the stream bed at site S₃ on July 21 approximately 165 meters below the cotton field contained 2 ppb permethrin (Table 6). Samples collected on July 21 at the point the runoff rivulet entered the stream, 2 miles downstream, did not contain measurable residues. None of 7 sediment samples collected from 4 sampling sites on July 27 contained measurable residues. On September 2, 1980, samples were collected 25 meters, 165 meters, 2 miles and 8 miles downstream. The two samples taken nearest the field had 2 and 3 ppb permethrin, respectively. The 2 samples taken further downstream did not contain measurable residues.

Water samples collected from the test streams contained residues ranging from <0.005 ppb to 0.42 ppb (Table 6). Three samples collected near the point of runoff (Site S₂) contained residues ranging from 0.035 ppb to 0.42 ppb. Samples collected further downstream contained residues concentrations varying from nondetectable to 0.035 ppb. It is unlikely that the permethrin detected in water at stations S₄ (Little Mulberry Creek) and S₅ (Alabama River) are the result of runoff from the test field.

3.0 SUMMARY

Permethrin was applied at 0.2 lb ai/A/Application by air craft at 5 days intervals for a maximum of 15 applications. The following residues were recorded:

3.1 Residues on Cotton Foliage:

After 15th application	17.6 ppm
7 days after 15th application	8.78 ppm
12 days after 15th application	4.87 ppm

3.2 Fall-Through Residues [on paper discs placed under the leaf canopy].

Maximum 0.043 lb ai/A.
Average 0.0132 lb ai/A (equivalent to 6.6% of the spray that penetrated the foliage and reached the soil).

3.3 Residues on Soil Surfaces [treated areas not protected by cotton plants]:

Maximum residues from 6" x 6" x 3" soil sample was 0.4 ppm.

3.4 Residues in Runoff Water:

Maximum 15.3 ppb

3.5 Residues in Sediment [stream, 65 m. below treated field]:

Maximum 2 ppb

3.6 Water Samples [from streams adjacent to treated cotton field]:

Maximum 0.42 ppb

4.0 COMMENTS

The levels of permethrin residues detected on plant foliage, on soil, in runoff water, and in sediment are, perhaps, more meaningful to RCB, EEB and Tox. Branches. EFB has no adverse comments.

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Review Section #1
Environmental Fate Branch
Hazard Evaluation Division

Table 1-a

Estimates of Soil Properties Specific to the Test Site,
Autauga County, Alabama

Soil files	Depth to Seasonal High Water Table (feet)	Depth from Surface (inches)	Dominant USDA Texture	Classification Unified/AASHTO	Perma- nency in/hr	Available Water Capacity inches/inch of soil	Organic Matter Content %	Bulk Density gm/cm ³	Initial friction rate in/hr
Jones- Shubert Assoc.	>6.0	0-12 12-52 52-73	Sandy loam & loamy sand Sandy loam Loamy sand	SM SM, SM-SC SM, SP-SM A-2 A-2 A-2	2.0-6.0 2.0-6.0 6.0-20.0	0.08-0.10 0.10-0.12 0.04-0.08	0.5-1.0	-	0.6-0.75
Lakeland Soils	>6.0	0-7 7-82	Loamy sand Sand	SM SM-SP A-2 A-3	6.0-20.0 6.0-20.0	0.05-0.09 0.02-0.06	0.5-1.0	1.35-1.55* 1.5-1.6*	0.75
Troup Loamy Sand	>6.0	0-64 64-80	Loamy sand Sandy loam	SM SM, SC A-2 A-4	6.0-20.0 0.60-2.0	0.05-0.10 0.10-0.13	0.5-1.0	1.35-1.65** 1.45-1.75** 1.50**	0.75
Withers Loamy Sand	>6.0	0-6 6-42 42-83	Fine loamy sand and loamy sand Clay loam, loam, sandy clay loam Loamy sand	SM ML, SC, CL A-4, A-6 SM A-2	0.60-2.0 0.60-2.0 2.0-6.0	0.12-0.14 0.12-0.15 0.08-0.11	0.5-1.0	1.35-1.65 1.30-1.40 Highly variable	0.5

*Depths 0-40", 40-80", respectively
**Depths 0-48", 48-64", 64-80", respectively

Treatment and Sampling Schedule
July-September 1980

Day	July	August	September
1			
2			R
3			
4			ICI(13)
5		ICI(7)	
6	ICI-F(1)		
7			
8			
9			FMC(14)
10		FMC(8)	
11	FMC(2)		
12			
13			
14			F,CS-ICI-F(15)
15		ICI(9)	
16	ICI(3)		
17			
18			
19			
20		F,CS-FMC-F(10)	
21	FMC-R(4)		F,CS
22			
23			
24			
25		ICI(11)	
26	F,CS-ICI-F(5)		
27	R		
28			
29			
30		FMC(12)	
31	FMC(6)		

FMC: Permethrin Treatment
 ICI: Permethrin Treatment
 F: Foliar Sample
 CS: Cotton Soil Sample
 R: Runoff Collected

Table 2

Permethrin Residues on Cotton Plants

Replicate Number	Sampling Date	Permethrin ppm ^{a/}	Replicate Number	Sampling Date	Permethrin ppm ^{a/}
F1A	7/06/80	22.4	F1A Pre	9/14/80	5.38
F2A	"	12.7	F1B Pre	"	8.19
F3A	"	b/	F2A Pre	"	0.17
Mean		17.6	F2B Pre	"	7.28
F1A Pre	7/26/80	4.49	F3A Pre	"	10.6
F1B Pre	"	4.56	F3B Pre	"	11.2
F2A Pre	"	4.28	Mean		7.14
F2B Pre	"	5.52	F1A Post	9/14/80	9.48
F3A Pre	"	3.77	F2A Post	"	13.0
F3B Pre	"	2.92	F3A Post	"	11.3
Mean		4.26	Mean		11.3
F1A Post	7/26/80	15.3	F1A	9/21/80	7.61
F2A Post	"	16.3	F2A	"	9.25
F3A Post	"	12.2	F3A	"	9.48
Mean		14.6	Mean		8.78
F1A Pre	8/20/80	2.75	F1A	9/26/80	7.16
F1B Pre	"	3.65	F2A	"	7.16
F2A Pre	"	5.17	F3A	"	0.29
F2B Pre	"	6.19	Mean		4.37
F3A Pre	"	2.07			
F3B pre	"	3.76			
Mean		3.93			
F1A Post	8/20/80	12.4			
F1B Post	"	7.19			
F2A Post	"	6.69			
F2B Post	"	8.74			
F3A Post	"	5.23			
F3B Post	"	6.47			
Mean		7.79			

a/ All values were corrected for recovery

b/ Lost during analysis

Table 3

Permethrin Residues in Filter Papers

Replicate Number	Sampling Date	Permethrin (lb/A) ^{a/}	Replicate Number	Sampling Date	Permethrin (lb/A) ^{a/}
1A	7/11/80	0.0373	1A	8/20/80	0.0077
2A	"	0.0194	2A	"	0.0018
3A	"	0.0151	3A	"	0.0046
1A	7/16/80	0.0194	1A	8/25/80	0.0025
2A	"	0.0229	2A	"	0.0118
3A	"	0.0118	3A	"	0.0065
1A	7/21/80	0.0168	1A	8/30/80	0.0112
2A	"	0.0101	2A	"	0.0065
3A	"	0.0115	3A	"	0.0122
1A	7/26/80	0.0411	1A	9/04/80	0.0089
2A	"	0.0092	2A	"	0.0423
3A	"	0.0115	3A	"	0.0369
1A	7/31/80	0.0075	1A	9/09/80	0.0082
2A	"	0.0044	2A	"	0.0216
3A	"	0.0092	3A	"	0.0078
1A	8/05/80	0.0006	1A	9/14/80	0.0430
2A	"	0.0100	2A	"	0.0233
3A	"	0.0092	3A	"	0.0162
1A	8/10/80	0.0079	1A	9/19/80	0.0018
2A	"	0.0100	3A	"	0.0018
3A	"	0.0100			
1A	8/15/80	0.0002	Mean		0.0132
2A	"	0.0034			
3A	"	0.0051			

^{a/} All values were corrected for recovery.

Table 4

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Permethrin Residues in Soil

Replicate Number	Sampling Date	Permethrin ppm ^{a/}	Replicate Number	Sampling Date	Permethrin ppm ^{a/}
CS1A	7/26/80	0.22	CS1A	8/20/80	0.072
CS1B	"	0.037	CS1B	"	0.089
CS2A	"	0.075	CS2A	"	0.67
CS2B	"	0.11	CS2B	"	0.67
CS3A	"	0.25	CS3A	"	0.12
CS3B	"	0.30	CS3B	"	0.16
	Mean	0.17		Mean	0.30
CS1B	9/14/80	0.17	CS1B	9/21/80	0.36
CS2B	"	0.61	CS2B	"	0.22
CS3B	"	0.41	CS3B	"	0.068
	Mean	0.40		Mean	0.22

^{a/} All values were corrected for recovery

Table 5

Permethrin Residues in Runoff Water

Sample Number	Sampling Date	Permethrin, ppb ^{a/}
R2AW	7/21/80	15.3
R2AW	7/27/80	13.9
R2BW	9/02/80	3.37

- ^{a/} All values were corrected for recovery.

Table 6

Permethrin Residues in Stream Sediment and Water

Sampling Date	Sediment		Water	
	Sample Number	Permethrin ppba/ a/	Sample Number	Permethrin ppba/ a/
7/21/80	S2AM	<2	S2AW	0.30
"	S3AM	2	S3AW	0.032
"	S4AM	<2	S4AW	0.030
"	S5BM	<2	S5AW	0.035
			S5BW	0.005
7/27/80	S2AM	<2	S2AW	0.035
"	S2BM	<2	S3AW	Trace
"	S3BM	<2	S4AW	<0.005
"	S4AM	<2	S4BW	0.008
"	S4BM	<2	S5BW	0.013
"	S5AM	<2		
"	S5BM	<2		
9/2/80	S2AM	2	S2AW	0.42
"	S3AM	3	S3AW	<0.005
"	S4AM	<2	S4AW	<0.005
"	S5AM	<2	S5AW	<0.005

a/ All values were corrected for recovery